Program Details + Learning Standards Alignments:

Entryways

Learning By Design in Massachusetts
A K-12 architecture and design education program

In this program, students in **grades 3-12** do in-depth design work by focusing on one entryway. Students in **grades 6-12** spend **six 1.5-hour sessions** analyzing entryways as symbol and as structure; and communicating their ideas through drawings, writings and models. Students in **grades 3-5** do a simplified version of the process over the course of **four 1.5 -hour sessions.**

As they design, students work alongside professional architects and explore design as a career path. They strengthen their skills in many subject areas as outlined in the **MA Curriculum Frameworks**:

Social Sciences: science and technology in the context of society, history and human affairs,
Science and Technology/ Engineering: the engineering design process; structures and materials,
Mathematics: geometry; estimation and measurement; slope; scale and proportion,
Visual Arts: methods, materials and techniques of sketching, schematic drawing, model-building; the elements and principles of design; graphic design,
Language Arts: composition, developing surveys, oral presentation.

In general the **Entryway Design** process goes like this:

Define the Design Problem:

Who, What, When, Where, Why and What Else?
In two-person design teams the students begin to define their design problem: e.g. create an entryway for a museum; or redesign the approach, entrance and lobby areas of their school.

They are introduced to the concept of Universal Design: design for people of all ages and abilities.

Guided by their *Design Process Checklist,* students develop and write out their *design programs:* Who are we designing for? Where is our site? When will our clients use our site? Why, and to do What? What Else should our design be?

To help identify "who" they will be designing for, and to establish a working sense of scale for their drawings and models, each student creates a ¼" = 1' scale figure.

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Investigate the Design Problem

The students develop and conduct user interviews to inform their analyses. On a site visit, the design teams closely observe the entrance to their school as well as other entrances around their town. They consider 'what is an entrance' and 'what does an entrance symbolize' using words and drawings; define the components of an entrance; and explore the ideas of entrance and structure using their bodies.

In the middle/high school program, the design teams sketch scale site plans of the landscapes and architectural features in the approach area of their entryway. They measure the school entrance facade using estimation, proportion, modules and 'mirror math' – a system that uses mirrors and similar triangles to find the height of an object. The students may also choose to focus attention on the steps of the entryway, drawing and calculating the slope of the stairs.

Generate Ideas: brainstorm, list, sketch, diagram…. and Choose the Best Solution

Creating Bubble Sketches: Synthesizing all that they have learned from their investigations, each design team draws "bubble sketches" on layers of trace paper to develop their ideas. Ideas for spaces evolve over several drafts—from general, loosely-drawn shapes, to more specific designs. Not-so-good ideas are left behind and good ideas become more clearly defined. Considerations include size and shape of façade elements, traffic patterns, views, and the relationship of the entryway to the outdoor and indoor spaces adjacent to it.

Describe the Solution through a Prototype (drawing or model)

Floor Plans and Elevation Drawings: After being introduced to the tools and processes involved, and practicing those skills, the students draw scale floor plans and elevation views.

In the middle/high school program, the Instructor may show the class how designers use computer-aided-drafting [CAD] software to draw floor plans, elevations and 3d views of entryways. As an extension activity, students may use CAD software to draw their own designs.

Building 3d Scale Models: Working from their site plans, the design teams build 3-d sites (on cardboard bases) for their models. Landscapes are crafted from common art materials. Using geometry and measurement they transfer their elevation drawings to foam core, making scale-model facades of their ideas.

Redesigning the Solution as needed: Mini-evaluations and group design meetings during the drawing and model-building phases help students to improve their designs.

Evaluate the Solution

Reviewing their work — from initial writing, to bubble sketches, to site plan, to elevation, to model — the students consider the success of their designs. In writing, they consider: "Does my design solution solve my design problem? "How well does it solve my problem? Could the design be modified or improved?"

Present the Solution

In the middle/high school program, each student may select from their portfolio of writings, photographs, process drawings and final drawings to create a design presentation board — a graphic means of displaying design ideas. The teams may also calculate the materials costs for their redesign projects, and include that information in their presentations.

Once the oral presentations are developed and practiced, the students present their final projects to school, community members and, if applicable, the project architects who will be involved in the designing and building of the actual entryway redesign.

This **Entryway Design** project was developed in collaboration with high school Mathematics classes; and then successfully piloted at younger grade levels as well. One group of students wanted to make their entrance more interesting and better display the true personality of the school: "We want to create a look that represents the arts perspective as well as the learning aspect of what goes on in our building." At their final presentations, both the audience and the young designers agreed that their designs did just that.

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Mathematics Standards

Geometry

6.G.1 Identify *polygons* based on their properties, including types of interior angles, perpendicular or parallel sides, and congruence of sides,…

6.G.2 Identify 3d shapes … based on their properties, such as edges and faces.

6.G.3 Identify relationships among *points, lines, and planes*, e.g., intersecting, parallel, perpendicular.

6.G.7 Identify types of *symmetry*, including line and rotational.

6.G.9 Match 3d *objects* and their 2d *representations*, e.g., nets, projections, and perspective drawings.

8.G.2 Classify figures in terms of congruence and similarity; apply these relationships to the solution of problems.

8.G.5 Use a straight-edge, compass, or other tools to…to draw geometric figures.

6.G.7 Identify three-dimensional figures (e.g., prisms, pyramids) by their physical appearance, distinguishing attributes, and spatial relationships such as parallel faces.

8.G.8 Recognize and draw two-dimensional representations of three-dimensional objects, e.g., nets, projections, and perspective drawings.

Number Sense and Operations

6.N.4 Demonstrate an understanding of *fractions* as a ratio of whole numbers…

6.N.9 Select and use operations to *solve problems* involving addition, subtraction, multiplication and division.

6.N.14 Accurately and efficiently add, subtract, multiply, and divide positive *fractions* and mixed numbers.

6.N.16 *Estimate* results of computations with whole numbers, and with positive fractions, mixed numbers, decimals, and percents. Describe reasonableness of estimates.

8.N.3 Use ratios and proportions in the solution of problems involving unit rates, scale factors.

8.N.10 Estimate and compute with fractions.

8.N.11 Determine when an estimate rather than an exact answer is appropriate and apply…

8.N.12 Select and use appropriate operations—addition, subtraction, multiplication, division, and positive integer exponents—to solve problems with rational numbers.

Measurement

6.M.1 Apply concepts of *perimeter and area* to the solution of problems. Apply formulas where appropriate.

6.M.2 Identify, measure, describe, classify, and construct various *angles, triangles, and quadrilaterals*.

6.M.3 Solve problems involving *proportional relationships* and units of measurement, e.g., same system unit conversions, *scale models*, maps, and speed.

8.M.1 Select, convert and use appropriate units of measurement or scale.

8.M.3 Apply formulas and procedures for determining measures, including those of area and perimeter/circumference; use technology as appropriate.

8.M.4 Use ratio and proportion (including scale factors) in the solution of problems, including problems involving similar plane figures and indirect measurement.

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Science and Engineering Technology Standards

Engineering Design Gr 6-8; Gr. 9-10

2.1 Identify and explain the steps of the engineering design process: identify the need or problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), redesign.

2.2 Demonstrate methods of representing solutions to a design problem, e.g., sketches, orthographic projections, multiview drawings.

2.3 Describe and explain the purpose of a given prototype.

2.4 Identify appropriate materials, tools, machines to construct prototype of an engineering design.

2.5 Explain how such design features as size, shape, weight, function, and cost limitations would affect the construction of a given prototype.

1.1 Identify and explain the steps of the engineering design process, i.e., identify the problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.

1.2 Demonstrate knowledge of pictorial and multi-view drawings (e.g., orthographic projection, isometric, oblique, perspective) using proper techniques.

1.3 Demonstrate the use of drafting techniques with paper and pencil or computer-aided design (CAD) systems when available.

1.4 Apply scale and proportion to drawings, e.g., ¼" = 1'0".

1.5 Interpret plans, diagrams, and working drawings in the construction of a prototype.

Communication Gr 6-8

3.1 Identify and explain the appropriate tools, machines, and electronic devices (e.g., drawing tools, computer-aided design, and cameras) used to produce and/or reproduce design solutions (e.g., engineering drawings, prototypes, and reports).

3.4 Identify and explain how symbols and icons are used to communicate a message.

English Language Arts Standards

Standard 1: Discussion

Standard 2: Questioning, Listening, and Contributing: gather relevant information for a research project or composition through interviews.

Standard 3: Oral Presentation

Standard 4: Vocabulary and Concept Development

Standard 19: Writing 19.16; 19.17; 19.21; 19.23;

Standard 20: Considering Audience and Purpose

Standard 21: Revising

Standard 22: Standard English Conventions

Standard 23: Organizing Ideas in Writing

Standard 25: Evaluating Writing and Presentations

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Visual Arts Standards

STANDARD 1 Methods, Materials, and Techniques: demonstrate knowledge of the methods, materials, and techniques unique to the visual arts.

STANDARD 2 Elements and Principles of Design: demonstrate knowledge of line, texture, shape, form, pattern, symmetry, space and composition [balance, repetition, rhythm, scale, proportion, unity, harmony, emphasis].

STANDARD 3 Observation, Abstraction, Invention, and Expression: demonstrate their powers of observation, abstraction, invention, and expression…Create 2D and 3D artwork…

STANDARD 4 Drafting, Revising, and Exhibiting: demonstrate the processes of creating and exhibiting artwork: drafts, critique, self-assessment, refinement, and exhibit preparation; visualize concepts in clear schematic layouts**;**, assess and reflect on work orally and in writing, revise work based on criteria; maintain a portfolio of sketches and finished work; prepare artwork for exhibitions.

STANDARD 5 Critical Response: describe and analyze their own work and the work of others using appropriate visual arts vocabulary;

STANDARD 6 Purposes and Meanings in the Arts: describe the purposes for which works of architecture were and are created; interpret the meanings of artistic works; describe how artistic production can shape and be influenced by the aesthetic preferences of a society.

STANDARD 8 Concepts of Style, Stylistic Influence, and Stylistic Change: demonstrate understanding of styles, stylistic influence, and stylistic change; identifying when and where art works were created; analyzing characteristic features of art works from various historical periods, cultures, and genres.

STANDARD 9 Inventions, Technologies and the Arts: describe, analyze how artists use and have used materials, inventions, and technologies; describe how artists use computer technology in their work.

STANDARD 10 Interdisciplinary Connections: apply knowledge of the arts to the study of other disciplines; apply knowledge of other disciplines in learning in and about the arts.